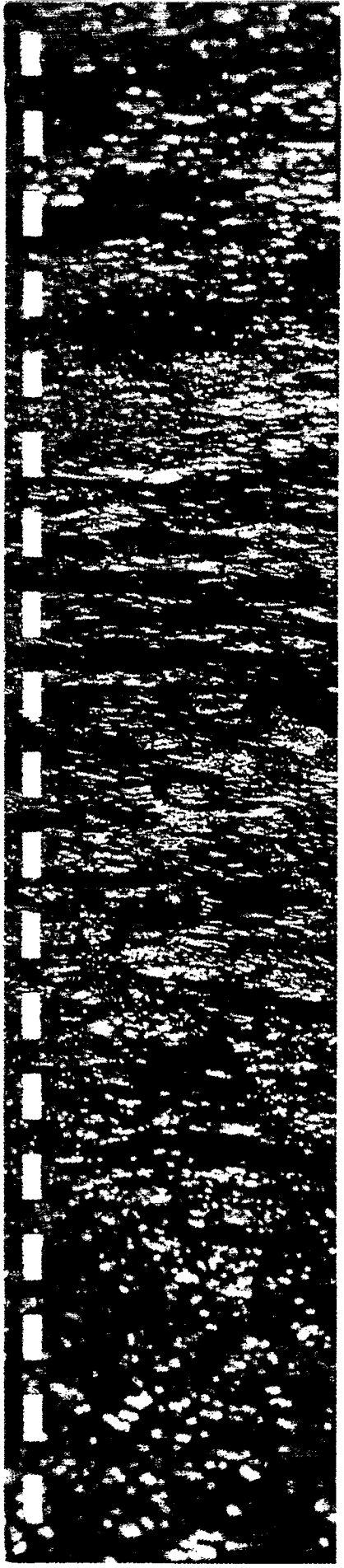

CONCEPT PAPER ON BAY-DELTA ESTUARY SUPPLEMENTAL WATER FROM THE NORTHERN CALIFORNIA AQUEDUCT

PREPARED BY

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In many years, the water inflow to the Bay-Delta Estuary does not occur in the proper amounts and times to meet instream environmental needs and water diversion requirements. With existing facilities, the restrictions on export pumping to protect fish are so limiting that state and federal water project contractors cannot receive their full entitlements. The estimated costs of alternative facilities to enhance the export water supply are so great that it is probably uneconomical to develop supplemental water supplies for irrigation unless a high-capacity, through-Delta facility is implemented to fully utilize the capacity of the California Aqueduct. Therefore, plans for satisfying supplemental water and instream environmental objectives in the Bay-Delta Estuary should be sized to primarily meet urban needs with the expectation that, for the foreseeable future, agriculture will depend on receiving export water only in above-normal water years.

OBJECTIVE OF CONCEPT PAPER

The objective of this concept paper is to formulate a plan of facilities to develop and transfer high quality unregulated and stored water from the Sacramento Valley for (1) urban needs in the San Francisco Bay Area and Southern California and (2) instream flows in the San Joaquin River while complementing water management in the Bay-Delta Estuary for environmental needs and satisfying area of origin requirements in project operations.

SUPPLEMENTAL WATER NEEDS

Several agencies in the Bay Area are actively searching for supplemental water supplies. The following brief summaries are based on information obtained from personal contacts and/or published reports.

City of Napa receives supplemental water from the North Bay Aqueduct of the State Water Project (SWP) under a maximum SWP/Napa County contract entitlement of 25,000 acre-feet annually. The City's allocation of the full entitlement is not sufficient for its needs. Furthermore, the SWP total supply in many years will be only about 50 percent of the total amount of all contracts. The City requires a supplemental supply in the order of 10,000 acre-feet annually, in addition to a full allocation of SWP water.

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Solano Water Authority also receives supplemental water from the North Bay Aqueduct. Its annual entitlement of 42,000 acre-feet may be reduced to about 50 percent in dry years. A recent report by the Authority estimated that it would need 70,000 acre-feet of water annually for municipal and industrial purposes in about 25 to 30 years to supplement its full existing supplies.

Contra Costa Water District presently receives water from the Central Valley Project (CVP) Contra Costa Canal and is constructing Los Vaqueros Dam and Reservoir with a new point of diversion from the Delta to firm up its average supply and for emergency purposes. The District cannot be certain it will obtain its full 195,000 acre-feet of CVP contract supply, and its needs may be even greater than that amount. At this time, the District is limited to 148,000 acre-feet under its CVP contract because environmental studies for the full amount have not been completed and approved. Its recently renewed CVP contract provides for 75 percent deliveries in dry years.

East Bay Municipal Utility District is studying alternative means of firming up its supplies from local sources and the Mokelumne River. The yield from the Mokelumne River is clouded by potential increases in instream flow requirements now under consideration by the State Water Resources Control Board (SWRCB). The District also has a CVP contract entitlement of 150,000 acre-feet of American River water from the Folsom South Canal, but instream requirements on the River limit the divertable water to wet years. Facilities have not been constructed to take the supply from the partially completed Folsom South Canal or, alternatively, directly from the American River.

Hetch Hetchy Water and Power will likely not be able to obtain adequate water for its service area from the Tuolumne River. The recent drought was more severe than previous droughts, and the Hetch Hetchy Aqueduct pipelines do not have sufficient capacity to fully use the potentially available supply. Under present conditions, San Francisco would need about 150,000 to 170,000 acre-feet of supplemental water annually to meet its long-term plans of providing about 400 mgd to its service area.

Three South Bay Aqueduct Water Contractors, Zone 7 of Alameda County Flood Control and Water Conservation District, Alameda County Water District, and Santa Clara Valley Water District, each are in need of supplemental water. In a 1991 study of alternative sources for the Districts, they estimated their supplemental needs as follows:

Water Contractor	Acre-feet
Zone 7	20,000
Alameda County Water District	10,000
Santa Clara Valley Water District	20,000
Total	**50,000**

The foregoing needs were predicated on receiving full contract supplies (188,000 acre-feet) from the South Bay Aqueduct. This is unlikely. The SWP can only provide about 50 percent of its contract supplies. Santa Clara Valley Water District also has CVP contract entitlement for 152,500 acre-feet. In critical years, this supply could be reduced by 25 percent.

Southern California. The 15 SWP water contractors south of the Tehachapi Mountains and in Santa Barbara and San Luis Obispo Counties, plus Improvement District No. 4 of Kern County Water Agency, have an aggregate municipal and industrial (M&I) contract entitlement of about 2.715 million acre-feet of which about 2 million acre-feet is with the Metropolitan Water District of Southern California. Delivery of only about 50 percent of the full entitlements can be made by the SWP with present facilities and operating constraints.

The foregoing CVP and SWP M&I contract entitlements are summarized as follows:

	SWP	CVP
	(1000 acre-feet)	
San Francisco Bay Area		
North Bay Aqueduct	67	
South Bay Aqueduct	188	
Contra Costa Water District		195
Santa Clara Valley Water District		152.5
East Bay Municipal Utilities District	____	(150)[1]
Subtotal	255	347.5
South of Delta		
Southern California	2,510.2	
Central Coastal Area	70.5	
Kern County Water Agency	134.6	
Subtotal	2,715.3	
TOTAL (rounded)	**2,970**	**350**

[1] *Excluded from total because delivery facilities do not exist and American River supply would be available only in wet years.*

Sacramento Valley. Water users in the Tehama-Colusa Canal water service area and southward into Yolo County do not all have sufficient amounts of CVP water. In 1988 the United States Bureau of Reclamation (USBR) prepared a Draft Environmental Impact Statement on the Sacramento River Service Area Contracting Program in which supplemental water requests are compiled. These requests total about 319,000 acre-feet. After review, the USBR concluded that the total need would be about 190,000 acre-feet. Additional requests from Yolo County were made for 73,000 acre-feet of which 42,000 acre-feet was for irrigation and 31,000 acre-feet for M&I purposes. The USBR did not change this estimate of need. The actual demand in the Sacramento Valley would

depend largely on the cost of irrigation water, because all but 31,000 acre-feet of the estimated demands would be for irrigation.

Summary of Supplemental Water Needs. The SWP can supply only about 50 percent of the M&I entitlements in dry years, or about 1.48 million acre-feet. CVP renewal contracts call for at least 75 percent deliveries in all but the driest of years. A 25 percent shortage would be about 90,000 acre-feet. Supplemental demands of the City of Napa, Solano Water Authority, and the three South Bay Aqueduct Contractors are in the order of 130,000 acre-feet. For purposes of this concept paper, it is assumed that Hetch Hetchy Water and Power and East Bay Municipal Utility District would require a combined total of 300,000 acre-feet of supplemental water. Supplemental M&I demands in Yolo County are about 30,000 acre-feet annually. Total M&I demands are, therefore, 2.03 million acre-feet in dry years, which is rounded to 2 million acre-feet in this paper.

The supplemental irrigation demand on the Tehama-Colusa Canal is estimated at 232,000 acre-feet, including Yolo County.

INSTREAM WATER REQUIREMENTS

Restoration of fishery resources in the San Joaquin River will require significant increases in the spring flows relative to flows generally maintained under present conditions. Studies by state agencies indicate that water supplies in the San Joaquin River produce per acre-foot benefits several times the benefits that would be produced by a comparable increase in flow from the Sacramento River. Additionally, water provided to the lower San Joaquin River will enhance the quality of water in the south Delta channels.

Proposals by the SWRCB for water for the San Joaquin River have placed emphasis on additional releases from Sierra Nevada streams, principally the Stanislaus, Tuolumne, and Merced Rivers. An alternative means would be to augment the supply in the Delta-Mendota Canal for release through one of its wasteways, such as the Westley Wasteway at Canal Mile 30.8 or, farther to the south, the Newman Wasteway at Canal Mile 50.9, each of which has a design capacity of over 4,000 cfs. This mode of operation would reduce the demands on the Tuolumne River and would permit Hetch Hetchy Water and Power to divert high quality water into the San Francisco Bay area, which in turn would enhance the potential for wastewater reclamation because the Tuolumne River water has very low dissolved mineral content relative to an alternative source such as pumping out of the Delta.

In Decision 1630, the SWRCB proposed a three-week pulse flow at Vernalis ranging from 2,000 to 10,000 cfs in critically dry and wet years, respectively, with a cap of 150,000 acre-feet for storage releases. In its December 1994 Water Quality Control Plan for the Bay-Delta Estuary, the SWRCB proposes spring flows for different types of water

years with the primary responsibility to meet these flows assigned to the CVP out of New Melones Reservoir. DWR studies indicate that it would be necessary to provide a long-term average of 134,000 acre-feet annually, in addition to New Melones releases, to meet the Vernalis criteria. During a critically dry period, the average annual additional supply would be 203,000 acre-feet. For purposes of this paper, an allowance of 150,000 acre-feet for release to the San Joaquin River is included.

PLAN OF FACILITIES

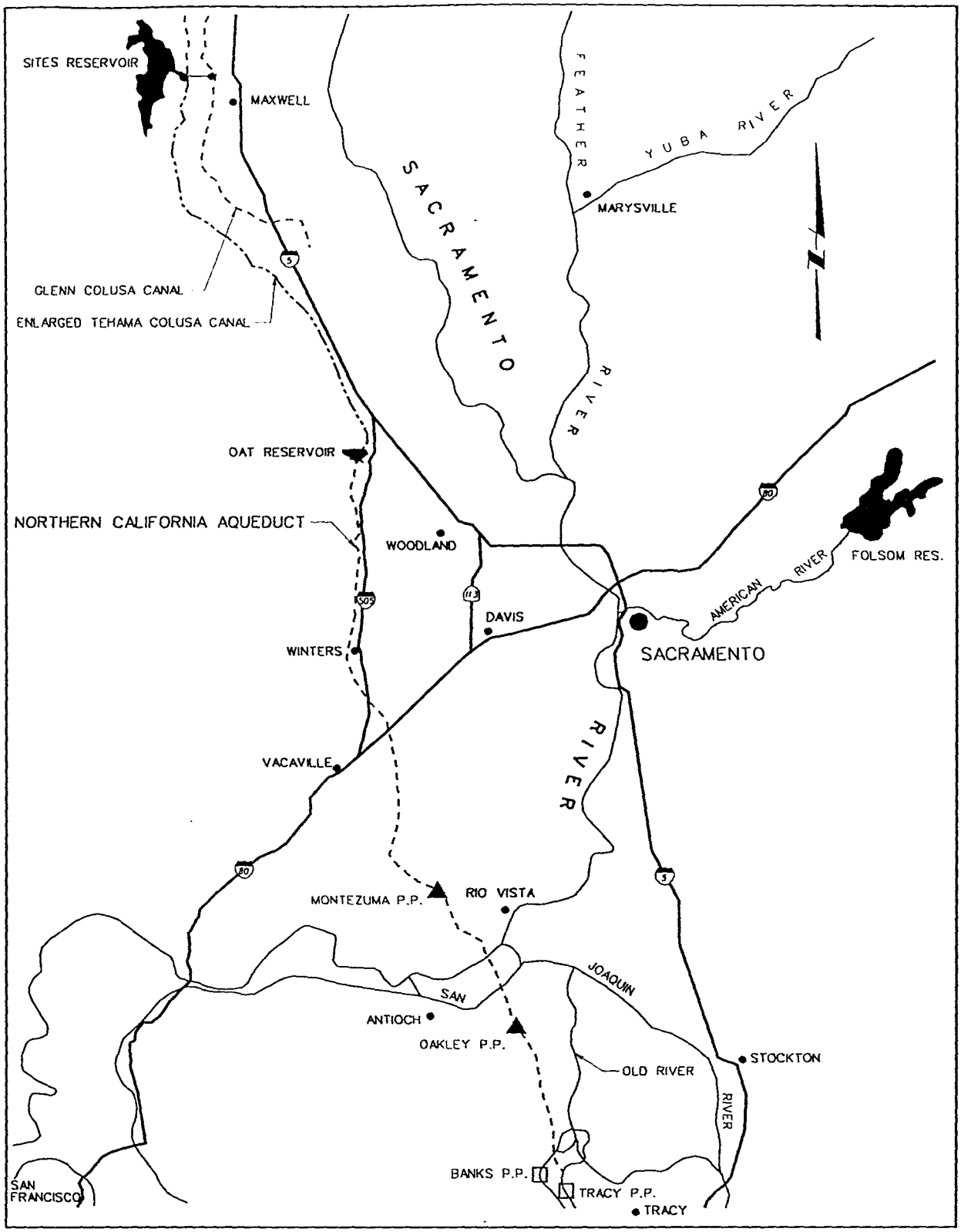
The Tehama-Colusa Canal was sized to meet the needs in its service area with regulation storage provided by Lake Shasta. The capability to provide such regulation will be dependent in part, on the amount of storage which may be required for environmental purposes.

Additional works to deliver water to the urban areas beyond the end of the Tehama-Colusa Canal would be most efficiently operated if the supplemental water could be delivered on a uniform schedule and the existing supplies for these areas operated to meet seasonal peak demands. Totally uniform flow is probably not practical. However, an allowance of about 20 percent excess conveyance capacity relative to uniform flow rate would be a reasonable target for operations. The general alignment and principal features of the proposed Northern California Aqueduct are shown on Plate 1.

To deliver water at a nearly uniform rate from the Sacramento Valley would require additional regulation for annual and drought period supplies. A potential storage site to supplement existing storage in Lake Shasta is the Sites Reservoir in western Colusa County, which has been intensively studied by the USBR and separately by the Department of Water Resources as part of a larger Colusa Reservoir. It could be constructed at a capacity of up to 1.2 million acre-feet. (Up to 3.1 million acre-feet could be stored by expanding the reservoir to a northern basin.) A reservoir could be filled by diversion from the Sacramento River using off-season capacity of the Tehama-Colusa Canal. This in turn would require year-round diversion from the Sacramento River at Red Bluff Diversion Dam and would be dependent upon successful implementation of fish screening facilities at that location. Additional conveyance capacity could be provided by use of the Glenn-Colusa Canal during times capacity is not required for irrigation. Fish screen improvements are also being made on the Glenn-Colusa Canal. These canals each have capacity for 2,100 cfs at the location where water would be pumped into Sites Reservoir and could jointly supply about 250,000 acre-feet per month.

The water supply could be a combination of CVP storage releases from Lake Shasta and unregulated flow below Lake Shasta. Impacts on fish due to diversions from the Sacramento River could be reduced by releasing CVP water from Black Butte

PLATE 1



ALIGNMENT AND FEATURES OF NORTHERN CALIFORNIA AQUEDUCT

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Reservoir into the Tehama-Colusa Canal and by diverting flows of Thomes and Elder Creeks into the canal. Water supply obligations of the SWP could be met by releases from Lake Oroville for exchange with CVP under the Coordinated Operations Agreement.

To meet the M&I and instream requirements, 2 million and 150,000 acre-feet, respectively, as previously discussed, and 20 percent incremental capacity for operational reasons would require about 3,500 cfs. The Tehama-Colusa Canal downstream from the Sites Reservoir was constructed with extra capacity to meet needs in Yolo and Solano Counties which have not been served because the canal has not been extended. To meet local irrigation needs downstream from Sites Reservoir, it would be necessary to dedicate about 500 second-feet of the existing capacity for that purpose. About 25.5 miles of the Tehama-Colusa Canal would need to be enlarged from 2,100 cfs to 4,000 cfs and 19.3 miles enlarged from 1,700 cfs to 4,000 cfs. An alignment for extension of the canal through Yolo County and into Solano County has been previously investigated by the USBR. The plans included completion of about three miles of the Tehama-Colusa Canal and Oat Reservoir (14,500 acre-feet) on Oat Creek in the Dunnigan Hills.

A canal with capacity for 3,500 cfs would be constructed southward from Oat Reservoir generally along and west of I-505. A connection could be made to Lake Solano, the forebay for the Putah South Canal, if locally desired. The canal could flow by gravity from the crossing of Putah Creek to the vicinity of Highway 12 between Rio Vista and Fairfield, where pumping facilities could be constructed to convey water through a new canal located through the Montezuma Hills. A siphon or tunnel could be constructed under the Sacramento Ship Channel and Sacramento River at Decker Island, terminating on Sherman Island. At the tunnel exit, the water could be conveyed in an open channel across Sherman Island to the entrance of a second tunnel under the San Joaquin River to Jersey Island. An open canal could be constructed southward on Jersey Island to a tunnel under Dutch Slough near its mouth at Big Break. It would be necessary to construct a second pumping plant on the south side of Big Break. From that point, water could be conveyed by canal across eastern Contra Costa County for discharge into the intakes for both Banks and Tracy Pumping Plants. The total length of the new aqueduct from the end of the existing Tehama-Colusa Canal to the intake of the Tracy Pumping Plant would be about 88 miles.

Some supplemental M&I water could be delivered in Yolo County, from the new canal or possibly Oat Reservoir. Water for irrigation in Yolo County would depend on the water pricing structure.

Facilities for water deliveries to Solano and Napa Counties could be made at the crossing of the North Bay Aqueduct, or alternatively, new facilities could be constructed to deliver water into Lake Solano and then into the Putah Canal. Deliveries for East Bay Municipal Utility District could be made by a connection with the District's Bixler

Pumping Plant on the Mokelumne Aqueduct. Deliveries for Contra Costa Water District could be made at the crossing of the Contra Costa Canal and/or additionally at the District's new intake for delivery into the Los Vaqueros Reservoir. Supplies for the South Bay Aqueduct Contractors would be released into the intake channel for the Banks Pumping Plant, where the existing capability of that plant would be utilized to deliver water into the California Aqueduct for SWP users south of the Delta. Some water could also be delivered to San Luis Reservoir for Santa Clara Valley Water District needs through the Pacheco Pass by either the California Aqueduct or the Delta Mendota Canal. Finally, good quality water could be delivered into the intake to the Tracy Pumping Plant, where it could be pumped and conveyed southward to the Westley Wasteway or the Newman Wasteway for release into the San Joaquin River to supplement the flows for fish. This would be an alternative means of meeting any obligations that Hetch Hetchy Water and Power might have for participation in outflow or in water supply to the Delta and would permit the Bay area to continue to receive increasing quantities of high quality water which would enhance the potential for wastewater reclamation.

COSTS

The estimated capital cost of the proposed facilities is in the order of $900 million. If the project is financed with 30-year tax-free bonds at 7 percent interest, the annual amortization cost would be about $72 million.

General operation and maintenance costs would be in the order of 1 percent of the capital costs or about $10 million annually. Wheeling payments would be made for off-season use of the Glenn-Colusa Canal. Power costs would depend principally on the source of power. If (1) CVP power is available for pumping CVP water, including 150,000 acre-feet for instream releases to the San Joaquin River, (2) SWP power sources are available for SWP water, and (3) commercial power is used for assumed deliveries for San Francisco and East Bay Municipal Utility District, the respective shares for power would be 11, 69, and 20 percent. The cost of power to pump into Sites Reservoir, with 50 percent recovery on the release, plus relift pumping at Montezuma Hills and Big Break, would be in the order of $25 per acre-foot.

Based on delivery of 2.15 million acre-feet per year, the cost would be about $38 per acre-foot for amortization and general operation and maintenance plus $25 for power or a total of about $63 per acre-foot.

OPERATIONS

Much of the water diverted to Sites Reservoir or for direct delivery would be from unregulated flow in the Sacramento River. Stored water would also be released from Shasta Reservoir, particularly in dry years. Exchanges for SWP use would be accounted under the State-Federal Coordinated Operations Agreement.

This concept for augmenting the high quality water supplies for urban areas would be a complement to diversions from the Delta through existing facilities as permitted within environmental constraints within the Delta. Substantial quantities of water can be diverted, particularly in better water supply years, at Banks and Tracy Pumping Plants. The Northern California Aqueduct will be expensive to construct, and the unit costs for water will likely be greater than the ability of agricultural areas to pay the cost. Such agricultural contractors could continue to have the benefits of lower cost water developed with existing facilities. Agricultural users served from the Tehama-Colusa Canal would, presumably, pay for water at CVP rates.

Delivery of high quality water directly to the south Delta affords insurance against a serious salinity incursion due to a levee break in the south Delta area. Water could be released from these facilities to flush out the saline water which otherwise would have an extended residence time and stop export pumping and crop losses in the Delta. The Northern California Aqueduct would provide insurance against a major seismic event which could interrupt export pumping from the Delta and/or deliveries through the Mokelumne Aqueduct of East Bay Municipal Utility District.

IMPLEMENTATION

This project could best be undertaken by a joint powers authority composed of the principal beneficiaries for two principal reasons. First, there can be substantial savings in cost as compared to either federal or state construction. Experience has shown that projects constructed by local agencies with private sector design and construction management can be at least 30 percent less costly than if constructed by the state or the USBR. The second reason is the diversity of interest in the project. Primary beneficiaries include some state water contractors, some federal water contractors, some with both sources, and others with neither. Some financial assistance from both CVP and SWP would be appropriate. Such payments could be used to support the financing through commercial sources.

SUMMARY

It appears that there will be continued uncertainty regarding the impacts of water diversions from the Delta on endangered species. There should be a cap on the obligations of the water users to provide water supplies for the Bay-Delta Estuary environment. It seems reasonable that a lower level of required diversions, particularly in dry years, with associated lower environmental impacts, would facilitate agreement.

A project that can meet water and environmental needs without further direct impact on the Bay-Delta Estuary should be susceptible of implementation earlier than a direct Delta fix.

The technology for constructing canals, pumping plants, and siphons or tunnels of the size necessary for this undertaking is well established.

The general sizing criteria used herein are based on supplemental capacity to meet full contract entitlements and additional supplemental demands. These target supply quantities could be lowered by adoption of service area drought conservation programs (reduced use) and a smaller system could be constructed.

The cost estimates set forth in this paper show the economic feasibility of the Northern California Aqueduct for meeting M&I demands.

The project would reduce the environmental impacts resulting from full dependence on diversions from the Delta by affording both reduced dependence and operational flexibility.

The technical aspects of the proposal need further resolution, but should be sufficiently set forth herein for serious evaluation of the institutional framework for proceeding. The affected entities should evaluate their interest in this project and develop a strategy for implementing the project.